

VOLUME 7
QH
1
S67X
NH

PART 10

APRIL 1977

ISSN 0303-2515

ANNALS

OF THE SOUTH AFRICAN
MUSEUM



CAPE TOWN



INSTRUCTIONS TO AUTHORS

1. MATERIAL should be original and not published elsewhere, in whole or in part.

2. LAYOUT should be as follows:

- (a) *Centred masthead to consist of*
Title: informative but concise, without abbreviations and not including the names of new genera or species
Author's(s') name(s)
Address(es) of author(s) (institution where work was carried out)
Number of illustrations (figures, enumerated maps and tables, in this order)
- (b) *Abstract* of not more than 200 words, intelligible to the reader without reference to the text
- (c) *Table of contents* giving hierarchy of headings and subheadings
- (d) *Introduction*
- (e) *Subject-matter* of the paper, divided into sections to correspond with those given in table of contents
- (f) *Summary*, if paper is lengthy
- (g) *Acknowledgements*
- (h) *References*
- (i) *Abbreviations*, where these are numerous

3. MANUSCRIPT, to be submitted in triplicate, should be typewritten and neat, double spaced with 2.5 cm margins all round. First lines of paragraphs should be indented. Tables and a list of legends for illustrations should be typed separately, their positions indicated in the text. All pages should be numbered consecutively.

Major headings of the paper are centred capitals; first subheadings are shouldered small capitals; second subheadings are shouldered italics; third subheadings are indented, shouldered italics. Further subdivisions should be avoided, as also enumeration (never roman numerals) of headings and abbreviations.

Footnotes should be avoided unless they are short and essential.

Only generic and specific names should be underlined to indicate italics; all other marking up should be left to editor and publisher.

4. ILLUSTRATIONS should be reducible to a size not exceeding 12×18 cm (19 cm including legend); the reduction or enlargement required should be indicated; originals larger than 35×47 cm should not be submitted; photographs should be rectangular in shape and final size. A metric scale should appear with all illustrations, otherwise magnification or reduction should be given in the legend; if the latter, then the final reduction or enlargement should be taken into consideration.

All illustrations, whether line drawings or photographs, should be termed figures (plates are not printed; half-tones will appear in their proper place in the text) and numbered in a single series. Items of composite figures should be designated by capital letters; lettering of figures is not set in type and should be in lower-case letters.

The number of the figure should be lightly marked in pencil on the back of each illustration.

5. REFERENCES cited in text and synonymies should all be included in the list at the end of the paper, using the Harvard System (*ibid.*, *idem*, *loc. cit.*, *op. cit.* are not acceptable):

(a) Author's name and year of publication given in text, e.g.:

'Smith (1969) describes ...'
'Smith (1969: 36, fig. 16) describes ...'
'As described (Smith 1969a, 1969b; Jones 1971)'
'As described (Haughton & Broom 1927) ...'
'As described (Haughton *et al.* 1927) ...'

Note: no comma separating name and year
pagination indicated by colon, not p.
names of joint authors connected by ampersand
et al. in text for more than two joint authors, but names of all authors given in list of references.

(b) Full references at the end of the paper, arranged alphabetically by names, chronologically within each name, with suffixes *a*, *b*, etc. to the year for more than one paper by the same author in that year, e.g. Smith (1969a, 1969b) and not Smith (1969, 1969a).

For books give title in italics, edition, volume number, place of publication, publisher.

For journal article give title of article, title of journal in italics (abbreviated according to the *World list of scientific periodicals*, 4th ed. London: Butterworths, 1963), series in parentheses, volume number, part number (only if independently paged) in parentheses, pagination (first and last pages of article).

Examples (note capitalization and punctuation)

BULLOUGH, W. S. 1960. *Practical invertebrate anatomy*. 2nd ed. London: Macmillan.

FISCHER, P.-H. 1948. Données sur la résistance et de la vitalité des mollusques. *J. Conch.*, Paris 88: 100-140.

FISCHER, P.-H., DUVAL, M. & RAFFY, A. 1933. Études sur les échanges respiratoires des littorines. *Archs Zool. exp. gén.* 74: 627-634.

KOHN, A. J. 1960a. Ecological notes on *Conus* (Mollusca: Gastropoda) in the Trincomalee region of Ceylon. *Ann. Mag. nat. Hist.* (13) 2: 309-320.

KOHN, A. J. 1960b. Spawning behaviour, egg masses and larval development in *Conus* from the Indian Ocean. *Bull. Bingham oceanogr. Coll.* 17 (4): 1-51.

THIELE, J. 1910. Mollusca: B. Polyplacophora, Gastropoda marina, Bivalvia. In: SCHULTZE, L. *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Süd-Afrika* 4: 269-270. Jena: Fischer. *Denkschr. med.-naturw. Ges. Jena* 16: 269-270.

(continued inside back cover)

ANNALS OF THE SOUTH AFRICAN MUSEUM
ANNALE VAN DIE SUID-AFRIKAANSE MUSEUM

Volume 72 Band
April 1977 April
Part 10 Deel



A SECOND ASSEMBLAGE OF PLIOCENE
INVERTEBRATE FOSSILS FROM
LANGEBAANWEG, CAPE

By

BRIAN KENSLEY

Cape Town Kaapstad

The ANNALS OF THE SOUTH AFRICAN MUSEUM

are issued in parts at irregular intervals as material
becomes available

Obtainable from the South African Museum, P.O. Box 61, Cape Town 8000

Die ANNALE VAN DIE SUID-AFRIKAANSE MUSEUM

word uitgegee in dele op ongereelde tye na beskikbaarheid
van stof

Verkrygbaar van die Suid-Afrikaanse Museum, Posbus 61, Kaapstad 8000

OUT OF PRINT/UIT DRUK

1, 2(1, 3, 5-8), 3(1-2, 4-5, 8, t.-p.i.), 5(1-3, 5, 7-9),
6(1, t.-p.i.), 7(1-4), 8, 9(1-2, 7), 10(1),
11(1-2, 5, 7, t.-p.i.), 15(4-5), 24(2), 27, 31(1-3), 33

Price of this part/Prys van hierdie deel
R2,50

Trustees of the South African Museum © Trustees van die Suid-Afrikaanse Museum
1977

ISBN 0 908407 10 6

Printed in South Africa by
The Rustica Press, Pty., Ltd.,
Court Road, Wynberg, Cape

In Suid-Afrika gedruk deur
Die Rustica-pers, Edms., Bpk.,
Courtweg, Wynberg, Kaap

A SECOND ASSEMBLAGE OF PLIOCENE INVERTEBRATE FOSSILS FROM LANGEBAANWEG, CAPE

By

BRIAN KENSLEY

South African Museum, Cape Town

(With 16 figures)

[MS. accepted 30 November 1976]

ABSTRACT

An assemblage of fossils from the Quartzose Sand Member of the Varswater Formation at Langebaanweg is described. The assemblage consists of 20 species of gasteropods, 2 species of bivalves, 1 amphineuran species, about 4 species of ostracodes, and the nucules of a species of the alga *Chara* (stonewort). Included amongst the molluscs is a new species of *Bullia*, to be described later by P. Nuttall of the British Museum, and a new species of the bivalve genus *Cuna* described here. The molluscs represent a mixture of marine, marine/estuarine, estuarine, freshwater, and terrestrial species. The ostracodes are all freshwater species. From the condition and relative abundance of the fossils, it is suggested that the specimens were deposited under very calm conditions in an estuarine area, perhaps after riverine flooding.

CONTENTS

	PAGE
Introduction	189
Systematic discussion	190
General discussion	207
Acknowledgements	209
References	209

INTRODUCTION

The commercial phosphate mine at Langebaanweg, Cape, has yielded a vast array of fossils, mainly of Pliocene age (*vide* Hendey 1976). The fossils are derived from the Varswater Formation, the geology of which is dealt with in some detail by Tankard (1975*b*). An assemblage of invertebrate fossils from the Gravel Member of this formation has been described (Kensley 1972). This suite was composed mainly of marine gasteropod and bivalve molluscs (both fossil shells and shell casts) but also included a single brachiopod and echinoderm, and barnacle fragments. Expansion of the quarrying activities has since exposed a second assemblage of invertebrate fossils in the south-western part of the mine. This material occurred in a mud deposit within the Quartzose Sand Member, which immediately overlies the Gravel Member. These are the fossils dealt with in the present report. All the material is housed in the South African Museum, whose catalogue numbers they bear.

SYSTEMATIC DISCUSSION

MOLLUSCA

Class GASTEROPODA

Family Trochidae

Gibbula benzi (Krauss)*Gibbula benzi*: Barnard, 1963: 276.*Material*

Single specimen, height 4,4 mm, width 5,0 mm.

Distribution

Living: East London to Saldanha.

Remarks

The colour pattern of white dots on the periphery, rows of dark and light dots on the base, and the spire slightly mottled, is well preserved.

Oxystele variegata (Anton)*Oxystele variegata*: Tankard, 1975a: 22.*Material*

Single specimen, height 6,0 mm, width 10,0 mm.

Distribution

Living: Natal to southern Angola.

Fossil: Port Elizabeth, Verlorevlei, Saldanha.

Remarks

The general colour of the specimen is dark brown, but remains of the colour pattern are still visible.

Family Phasianellidae

Tricolia capensis (Dunker)

Fig. 1

Tricolia capensis: Barnard, 1963: 206.*Material*

Numerous specimens, from 1,6 mm to 4,0 mm in height.

Distribution

Living: False Bay to Kunene River mouth.

Remarks

All the specimens retain the characteristic colour pattern of a pale ground with darker pink-brown spots and mottling.

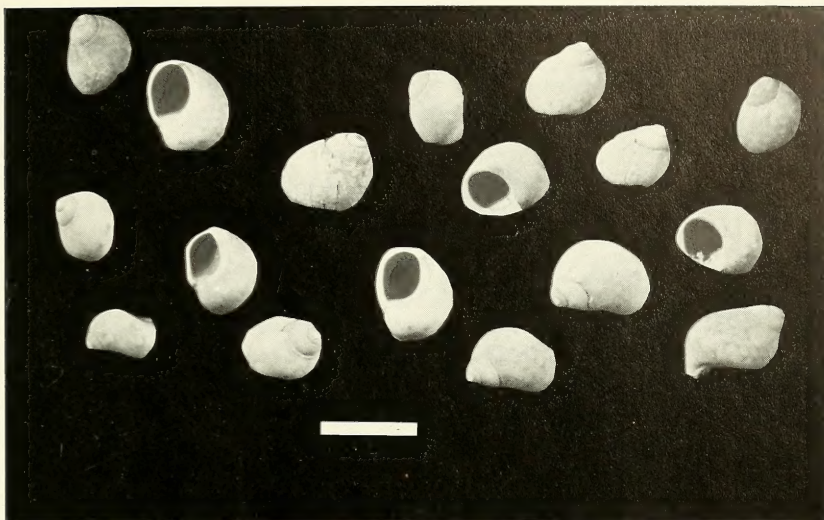


Fig. 1. *Tricolia capensis* (scale = 3 mm).

Tricolia neritina (Dunker)

Tricolia neritina: Kensley, 1972: 177.

Material

Two specimens, greatest diameter 3,4 mm, 2,0 mm.

Distribution

Living: East London to South West Africa.

Fossil: Langebaanweg.

Remarks

Both specimens retain the spiral colour bands of this species.

Family **Littorinidae**

Littorina cf. *knysnaensis* (Philippi)

Littorina knysnaensis: Tankard, 1975a: 22.

Material

Two damaged specimens, greatest diameter of larger specimen 5,0 mm.

Distribution

Living: Natal to Rocky Point, South West Africa.

Fossil: Saldanha, Verlorevlei, Knysna.

Remarks

Both specimens are low-spired, showing about twenty-five spiral lines on the body whorl, plus numerous fine growth lines characteristic of this species. A basal keel as is found in specimens living in strong wave action, is not present.

Family **Collumbellidae***Pyrene albuginosa* (Reeve)

Fig. 2

Pyrene albuginosa: Barnard, 1962: 190.

Material

Thirteen specimens ranging in height from 3,5 mm to 7,4 mm.

Distribution

Living: Natal to False Bay.

Fossil: Port Elizabeth.

Remarks

Several of the specimens show two irregular rows of white spots on the body whorl, white spots at the suture, and a darker reticulation between the spots.

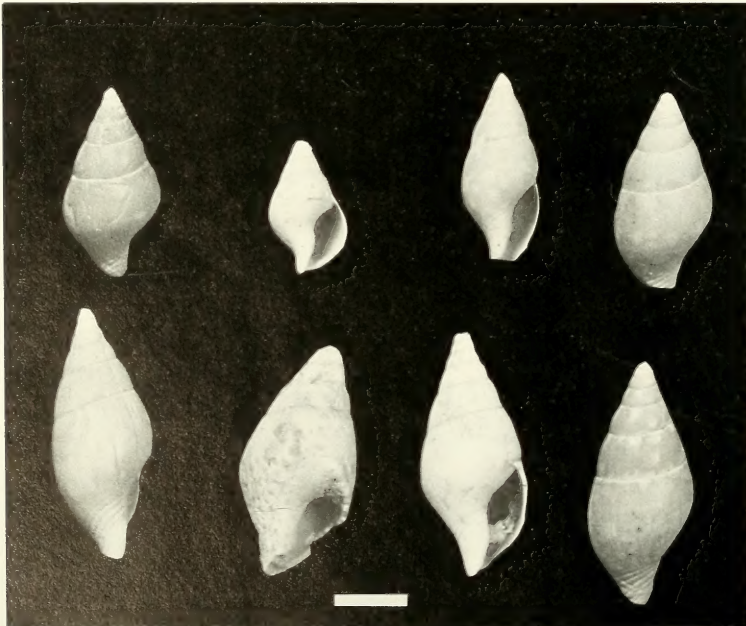


Fig. 2. *Pyrene albuginosa* (scale = 2 mm).

Family Nassariidae

Bullia digitalis (Meuschen)

Bullia digitalis: Barnard, 1959: 137.

Bullia sp. Kensley, 1972: 179.

Material

Ten specimens, all damaged, largest 20 mm length.

Distribution

Living: Port Elizabeth to Walvis Bay.

Fossil: Lüderitz, Orange River, Langebaanweg, Keurbooms River.

Bullia laevissima (Gmelin)

Bullia laevissima: Tankard, 1975a: 23.

Material

Eight specimens, all damaged, length 6,0 mm to 21,0 mm.

Distribution

Living: Port Alfred to Walvis Bay.

Fossil: Bogenfels, Saldanha, Knysna.

Bullia sp.

Fig. 3

Remarks

Large numbers of this species varying in size from protoconch plus a few postnatal whorls, to specimens up to 18 mm in length have been collected. P. Nuttall of the British Museum is of the opinion that this is an undescribed species and will be dealing with it in a later work.

Nassarius cf. *analogicus* (Sowerby)

Fig. 4

Nassa analogica: Barnard, 1959: 99.

Nassarius analogicus: Tankard, 1975a: 22.

Material

Three specimens, protoconchs missing, length 16,2 mm to 18,9 mm.

Distribution

Living: East London to St Helena Bay.

Fossil: Saldanha.

Remarks

Although the specimens are very worn, traces of the spiral lirae characteristic of this variable species can be seen. Only faint traces of axial ribs are visible on the upper whorls.

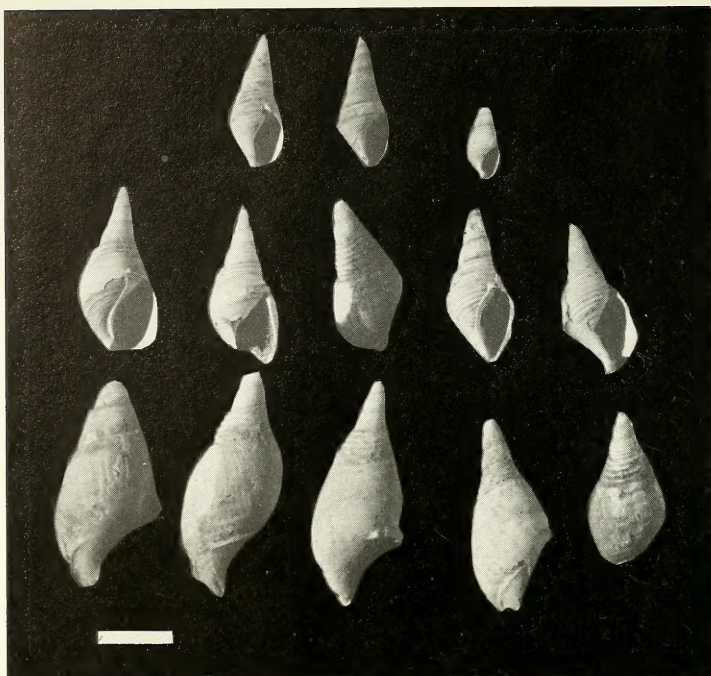


Fig. 3. *Bullia* sp. (scale 5 mm).

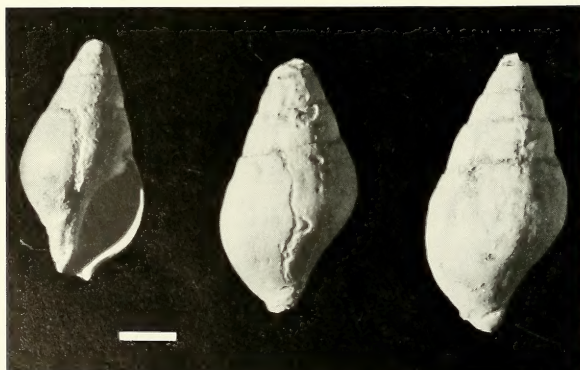


Fig. 4. *Nassarius* cf. *analogicus* (scale = 4 mm).

Nassarius sp.

Fig. 5

Description

Protoconch smooth, $2\frac{1}{2}$ whorls; 2 postnatal whorls, first whorl with 14–15 axial ribs, second whorl with 14–15 ribs. First whorl with 5 spiral lirae, 6–7 on second whorl, 4 on rostrum, 4–5 slightly stronger lirae on base.

Material

One damaged specimen, outer lip broken, length 3,3 mm, width 1,8 mm.

Remarks

The specimen agrees well with material of *N. plebeja* (Thiele) from Port Elizabeth, and with Barnard's (1959: 106) description. As this living species has only been recorded from relatively deep water (80–100 metres) no certainty can be placed on this identification.

Nassarius sp.

Fig. 6

Description

Protoconch plus $4\frac{1}{2}$ whorls, outer lip and base of shell damaged. Spire tapering evenly, apical angle 45° . Axial ribs well separated bent slightly near upper suture, and forming barely perceptible shoulder, 9–11 axial ribs per whorl. Periphery of body whorl with single spiral lira stronger than other faint lirae, latter almost obscure, about twelve per whorl.

Material

One specimen, damaged, length 15,5 mm width 7,0 mm.



Fig. 5. *Nassarius* sp. (scale = 1 mm).

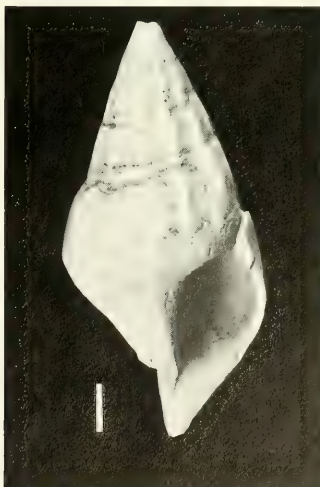


Fig. 6. *Nassarius* sp. (scale = 2 mm).

Remarks

The specimen closely resembles *N. scopularcus*, known as a Tertiary fossil from Bogenfels, Saldanha, and taken alive from Langebaan and Lüderitz, but differs in the shape of the profile. *N. scopularcus* has a slightly convex profile, as opposed to the present straight-sided specimen.

Family Marginellidae*Marginella* sp.*Material*

One specimen, length 2,9 mm.

Remarks

This species belongs to the group possessing a smoothly convex shoulder, three columellar pleats. In general form there is some resemblance to *M. differens*.

Family Assimineidae*Assimineea* sp.

Fig. 7

Material

Numerous specimens, length ranging from 2,4 mm to 4,0 mm.

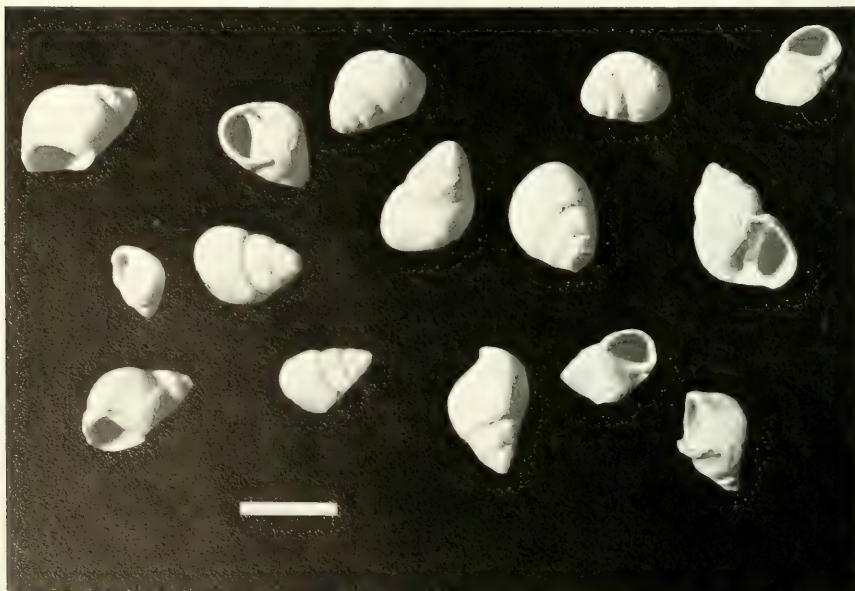


Fig. 7. *Assimineea* sp. (scale = 3 mm).

Remarks

In proportions this species resembles *A. bifasciata* but does not appear to reach this species size. The present species is not quite as rounded and squat as *A. globulosus*, but falls within that species size range.

Family **Ferrissiidae***Burnupia capensis* (Walker)

Fig. 8

Burnupia capensis: Connolly, 1939: 521. Burch, 1975: 54.

Material

Numerous specimens, largest length 4,0 mm, width 2,3 mm.

Distribution

Living: Natal to southern Cape and Cape Peninsula.

Subfossil: from vlei deposit, Cape St Francis.

Remarks

As Burch (1975) has shown, the nature of the apical sculpture in the fresh-water limpets is a very useful feature for separation of species. With this in view, scanning electron micrographs were obtained of the present material. These show the subapical rows of pits characteristic of *B. capensis*, but the rows of pits are not as numerous as in the modern material figured by Burch. The shape of the pits, however, is closer to *B. capensis* than to *B. stenochorias* with its sparser pit rows. None of the present specimens reach the size of the type or the fresh material in the South African Museum (i.e. up to 7,5 mm in length) of *B. capensis*, which is itself a smaller species than a normal *B. stenochorias* (length 8,5 mm).

Family **Planorbidae***Ceratophallus natalensis* (Krauss)

Fig. 9

Planorbis natalensis Krauss, Connolly, 1939: 490.

Ceratophallus natalensis: Brown & Mandahl-Barth, 1973: 289.

Material

Numerous specimens, greatest diameter 4,7 mm.

Distribution

Living: eastern Africa from Eritrea to eastern Cape, westwards to Chad and lower Congo.

Remarks

Connolly notes that populations of this species may for years remain below the normal adult dimensions before reaching full size. This may account for the small average size of the present material.

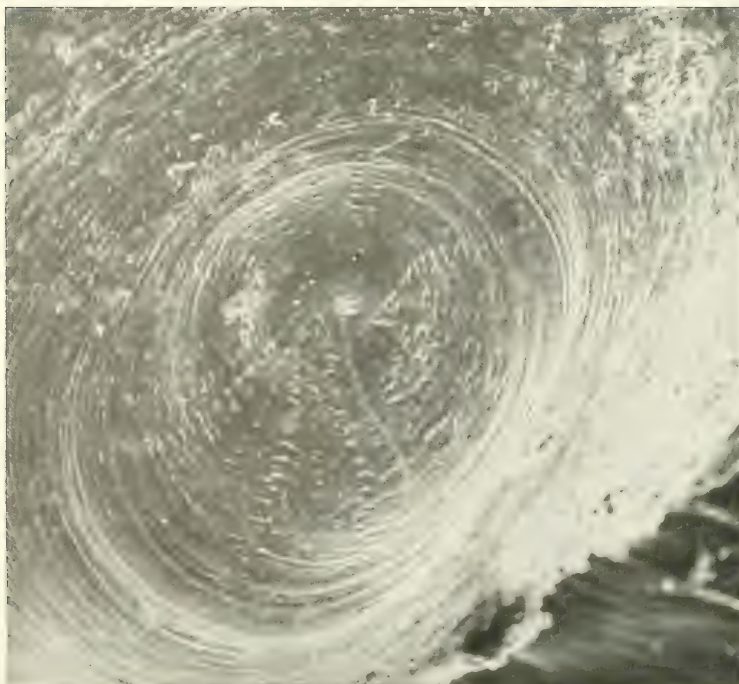


Fig. 8. *Burnupia capensis* (scale = 1 mm) with electromicrograph enlargement of apex.

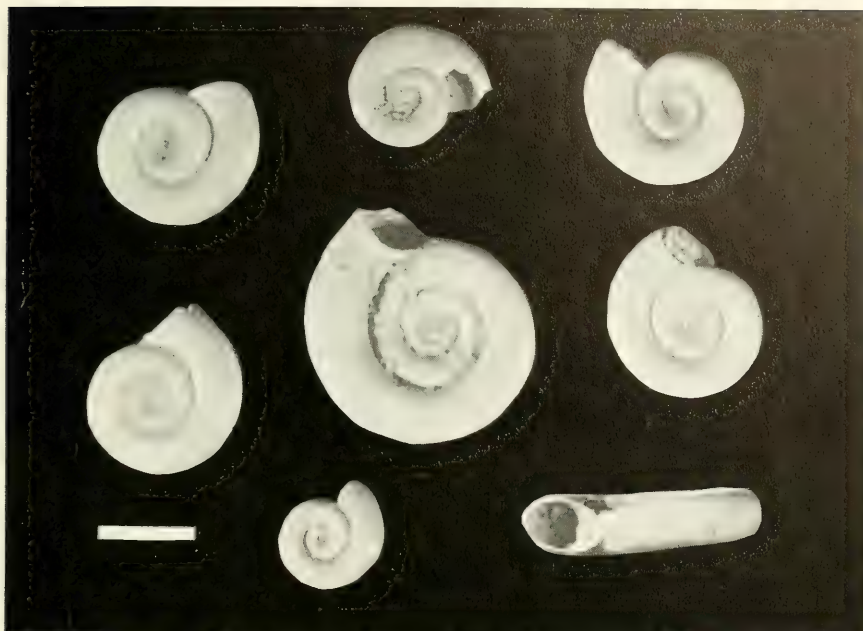


Fig. 9. *Ceratophallus natalensis* (scale = 2 mm).

Bulinus 'tropicus' (Krauss)

Fig. 10

Bulinus tropicus: Connolly, 1939: 499.

Material

Numerous specimens. Largest, length 3,9 mm, width 3,2 mm.

Distribution

Living: entire Republic of South Africa, Lesotho, Rhodesia, Botswana.
Subfossil: South West Africa.

Family **Endodontidae**

Trachycystis cf. *capensis* (Pfeiffer)

Fig. 11

Trachycystis capensis: Connolly, 1939: 228. Van Bruggen, 1970: 457.

Material

Seven specimens up to 4,2 mm width, 2,7 mm length.

Distribution

Living: East London to Orange River Mouth, common in coastal sand dunes, seldom extending more than 24 km inland. Recorded from 'Langebaan, under stones in dry sand fields' (Van Bruggen 1970: 458).

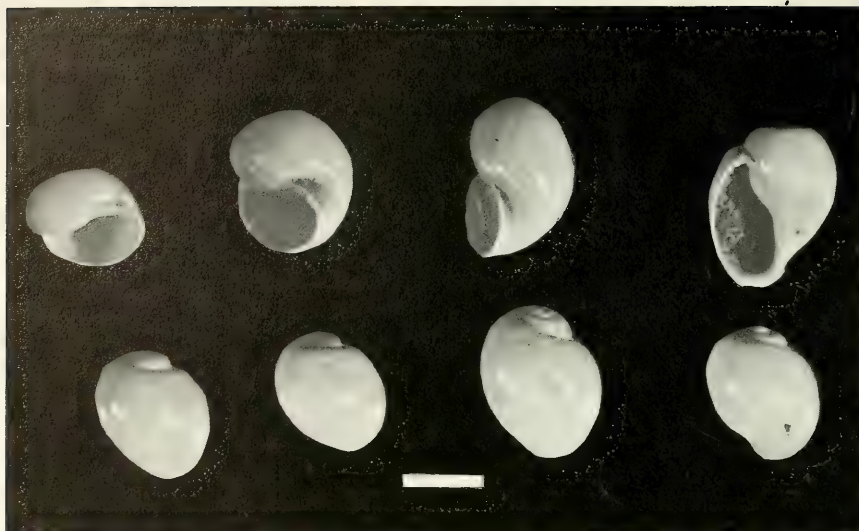


Fig. 10. *Bulinus* '*tropicus*' (scale = 2 mm).

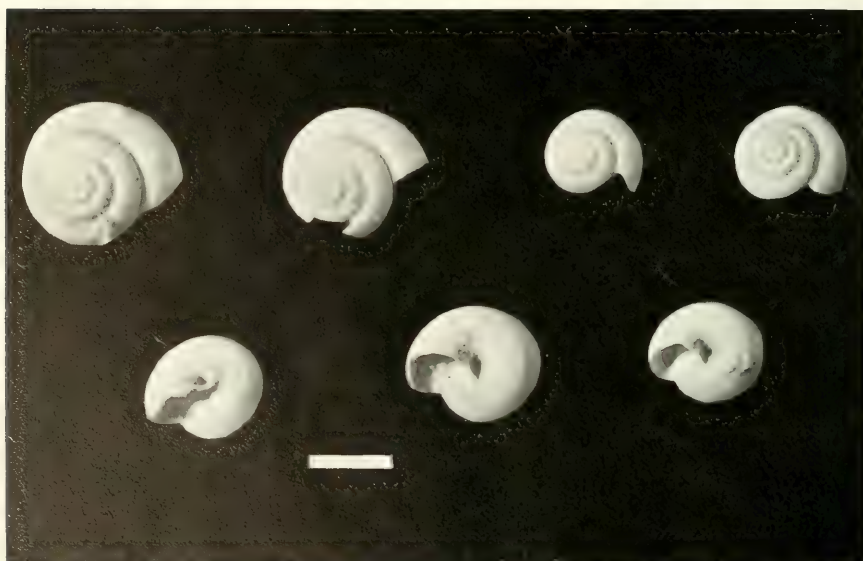


Fig. 11. *Trachycystis* cf. *capensis* (scale = 2 mm).

Family **Succineidae***Succinea* sp.

Fig. 12

Material

One specimen, length 3,3 mm, width 1,9 mm.

Remarks

In the relatively slender shape of the dextral shell, its very delicate structure, this specimen resembles the genus *Succinea*. Without more material (and the lack of soft parts) further identification is not possible.

Family **Hydrobiidae***Tomichia ventricosa* (Reeve)

Tomichia ventricosa: Connolly, 1939: 573.

Material

Two fragments.

Distribution

Living: southern Cape and Cape Peninsula.

Remarks

Although the material is fragmented, it agrees well with subfossil as well as fresh material of this species.

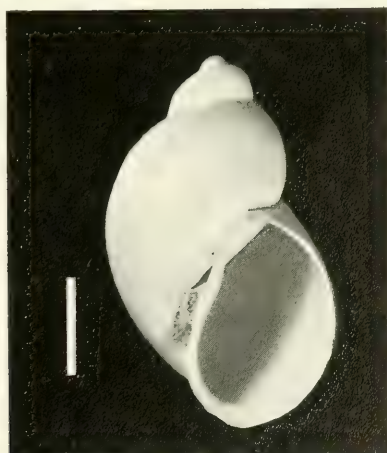


Fig. 12. *Succinea* sp. (scale = 1 mm).

? Family

Fig. 13

Material

Numerous shell apices, lower portion of shell never present, maximum diameter 4,0 mm.

Remarks

There can be no certainty about the status of this species until a complete specimen is found. The very flattened spire is similar to that of many of the Naticidae. The rather delicate shell, however, is unlike most *Natica* species, and the possibility that this is a freshwater or terrestrial species cannot be ruled out.

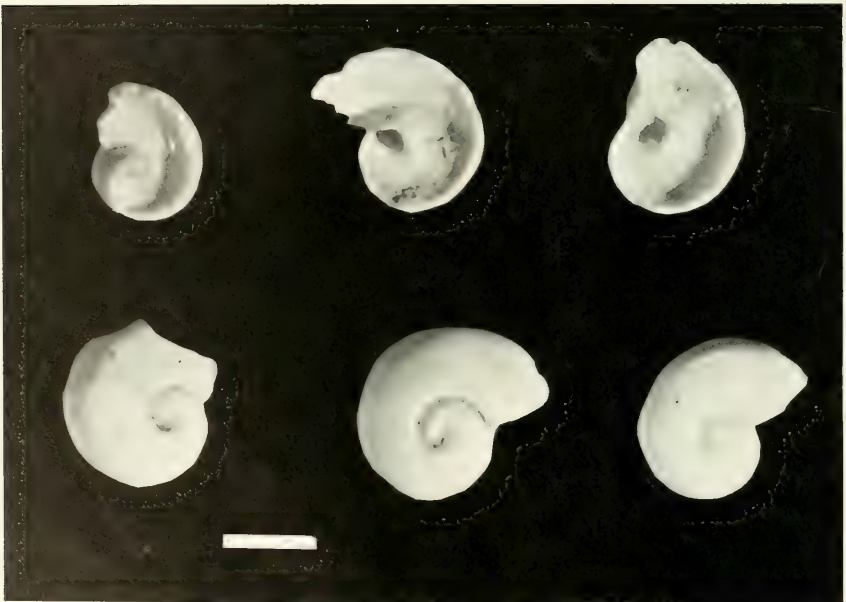


Fig. 13. ? Family (scale = 2 mm).

Class AMPHINEURA

Family Chitonidae

Chiton nigrovirescens (Blainville)

Fig. 14

Chiton nigrovirescens: Barnard, 1963: 342.

Material

Single valve, 11,5 mm wide.

Distribution

Living: False Bay to Lüderitz.

Remarks

The single valve agrees exactly with a valve taken from a living animal, in the shape of the apophyses, the ribbed lateral area and the pectinate margin with its single slit.

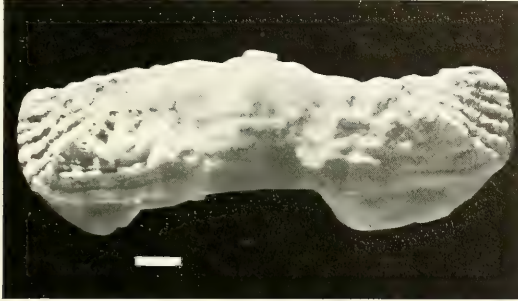


Fig. 14. *Chiton nigrovirescens* (scale = 1 mm).

Class PELECYPODA

Family **Donacidae**

Donax serra (Röding)

Donax serra: Tankard, 1975a: 24.

Donax cf *serra* and *Donax* sp., Kensley, 1972: 183.

Material

Numerous fragments of left and right valve hinges, also several fragments of the blade of the shell.

Distribution

Living: Kei Mouth to Walvis Bay.

Fossil: Angras Juntas, Oranjemund, Alexander Bay, Saldanha, Langebaanweg, Milnerton, Sedgfield.

Remarks

All the material is very fragmented, mainly hinge-lines surviving. Nevertheless, comparison with recent material of similar size shows no differences in hinge structure, while the characteristic serrations of the lower margin of this species are visible in some of the fragments.

Family **Carditidae**

Cuna aquaedulcensis sp. nov.

Fig. 15

Description

Valves inequilateral, umbo to anterior margin longer than umbo to posterior margin length. Posterior margin straight. Sculpture consisting of 20–21

radiating ribs crossed by numerous concentric growth lines, thus forming elongate-rounded tubercles. Inner ventral margin crenulate, mantle line uninterrupted. Hinge line with anterior cardinal tooth elongate, low; posterior cardinal tooth reduced to low knob. Median tooth relatively strong, narrowly triangular, separated from anterior tooth by narrow gutter. Posterior tooth forming part of shell margin. Single low lateral tooth on anterior margin.

Material

Holotype, right valve, length 3,4 mm, height 3,1 mm, SAM-L25892W.

Paratype, right valve, length 3,4 mm, height 3,1 mm, SAM-A25892W.

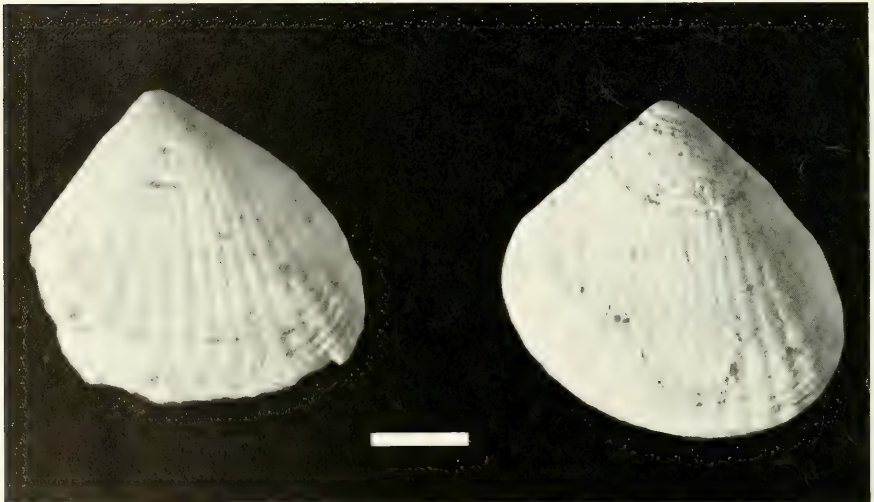


Fig. 15. *Cuna aquaedulcensis* (scale = 1 mm).

Remarks

This species most closely resembles the West African *Cuna gambiensis* Nicklés, 1955. This similarity lies in the overall proportions, and in the external sculpture. The West African species, however, has more radiating ribs (26) than *C. aquaedulcensis*, while examination of the hinge lines shows obvious differences. The right valve of *C. gambiensis* possesses three distinct cardinal teeth, while the posterior cardinal tooth in the present species is reduced to a knob. Little is known of the habits of these tiny bivalves. The specific name is derived from the Varswater (freshwater) Formation in which it was found.

ARTHROPODA

Class CRUSTACEA

Subclass OSTRACODA

A vast number of perfect ostracode valves, often both valves together, was obtained by sieving of the present sediments. Only about 5 species appear to be present, and of these 2 are abundant, the other 3 relatively uncommon. Difficulty was experienced in identifying these latter; one is probably a *Heterocypris* sp. There is little doubt, however, that the ostracodes are of freshwater origin.

Family Cytheridae

Gomphocythere expansa (Sars)

Gomphocythere expansa: McKenzie, 1971: 162, 195.

Distribution

Living: known only from the Cape Flats.

Remarks

This is the most abundant ostracode in the sediments, and occurs in thousands, often with the two valves joined. The very tumid shape and the flattened ventral surface with its sharply marked ridge make this species quite distinctive. Comparison with Sars's type material revealed no differences from the present material.

Family Cyprididae

Zonocypris cordata (Sars)

Zonocypris cordata: McKenzie, 1971: 169, 194.

Distribution

Living: vicinity of Cape Town, Port Elizabeth.

Remarks

This is the second most abundant species from the sediments, very often occurring with both valves joined. Comparison with Sars's type material revealed no differences.

CHAROPHYCOPHYTA (Stoneworts)

Chara sp.

Fig. 16

Material

Numerous nucules (♀ sexual reproductive structures).

Remarks

In spite of their varying proportions, these nucules are all composed of four spiral cells, thus placing the material in the genus *Chara*. R. D. Wood, of the University of Rhode Island, U.S.A., who looked at the material, gave the opinion that all the nucules belonged to the same species, variation in proportions being quite usual. Without further structures, specific identification is difficult. However, two possibilities present themselves:

Chara globularis a brackish water species usually living in water of a salinity of 5–15‰.

Chara vulgaris a purely freshwater species.

This is the first record of a fossil alga from Langebaanweg. Previous plant remains from the area include roots and pollen grains from the peat deposit, as well as plant fragments (Hendey 1976: 243).



Fig. 16. Nucules of *Chara* sp. (scale = 0,4 mm).

GENERAL DISCUSSION

As already mentioned, this assemblage of fossils was recovered from a fine-grained horizon in the Quartzose Sand Member of the Varswater Formation. Speculation on the environmental conditions under which the animals lived can be aided by two sources of information, viz. knowledge of the geology of the area, and present-day ecological knowledge of the same or related species.

Regarding the geological evidence, Tankard (1975*b*) has described the broad series of events in the area, viz. a marine transgression in the Pliocene, the accumulation of freshwater estuarine sands behind a barrier followed by a final marine transgression. In the Quartzose Sand Member Tankard recognizes in the sediments a fluvatile facies as well as an estuarine facies. A broad analysis of the present fossil assemblage and what knowledge we have of the environmental niches of these species, supports to some extent this geological view.

The fossils may be divided into the following categories:

MARINE SPECIES

Bullia digitalis
Chiton nigrovirescens
Donas serra
Gibbula benzi
Pyrene albuginosa
Tricolia capensis
Tricolia neritina

ESTUARINE SPECIES

Assiminea sp.

TERRESTRIAL SPECIES

Trachycystis capensis

MARINE/ESTUARINE SPECIES

Bullia laevissima
Littorina cf knysnaensis
Marginella sp.
Nassarius spp.
Oxystele variegata

FRESHWATER SPECIES

Ceratophallus natalensis
Bulinus tropicus
Burnupia capensis

Chara sp.

Gomphocythere expansa
Succinea sp.
Tomichia ventricosa
Zonocypris cordata

Under the marine/estuarine group are included species which have been recorded in both habitat types, as well as those forms which are only tentatively identified, and whose genera are usually marine, but sometimes also estuarine, e.g. *Nassarius*.

The assemblage is thus obviously a mixture of species from a variety of habitats, with major contributions from the marine and the freshwater representatives. If the assemblage is looked at in terms of abundance (even though

no quantitative collecting as such was done), it becomes apparent that a few species are very common, the rest being rare. These abundant species are the following:

MARINE SPECIES

Tricolia capensis

FRESHWATER SPECIES

Ceratophallus natalensis

Bulinus tropicus

Burnupia capensis

Gomphocythere expansa

Zonocypris cordata

The new species of *Bullia* is probably not a freshwater species, but whether it is purely marine or marine/estuarine, is uncertain. The abundance of all stages of these *Bullia* shells, and their good state of preservation, however, suggests that this was an estuarine species.

To speculate on the environmental conditions at the time of deposition, not only the species composition (and their ecological implications) must be considered, but also the sediments and the state of preservation of the fossils. The following points are of relevance in this connection: the sediments are very fine with a considerable clay fraction; many of the ostracodes are undamaged and often both valves are still joined; the nucules of *Chara* are often complete, in spite of the very delicate and brittle nature of the spiral cells; *Bulinus*, *Burnupia*, and *Ceratophallus* are small, very delicate shells, yet the majority of specimens are undamaged. Deposition must thus have taken place under very calm conditions.

To explain the presence of marine, estuarine, and freshwater species in the sediments, one must postulate a lagoonal/estuarine area, protected from wave action, yet with access to the sea. Close to this sea-mouth, there must have been both rocky shores (to accommodate *Tricolia*, *Pyrene*, *Oxystele*, and *Chiton*), and sandy shores (*Donax*, *Bullia digitalis*). Tidal movement could wash these marine forms into the sheltered lagoon, the larger shells such as *Donax* and *Bullia* becoming abraded and fragmented, the smaller shells of *Pyrene* and *Tricolia* surviving intact. (Movement of shells of the two former genera into a lagoon from the sea has been observed by the author at Milnerton.) That the rocky shores were nearby is implied from the condition of the *Pyrene* and *Tricolia* shells. These are without exception unworn, with the protoconches preserved, and in most cases, the colour patterns still visible. The true estuarine forms could have lived along the lagoonal/estuarine shores (*Assimineia* sp.) or on the muddy bottom (*Bullia laevissima*). The Charophyte alga probably flourished in a pond or temporary pool, isolated from the general estuary (as shown in Hendey 1976, fig. 2). (Charophytes, which are abundant on the present-day Cape Flats, are usually found in quiet ponds, shallow water holes, temporary pools, and dams (Stephens 1929).) The large numbers of fluviatile molluscs and ostracodes might have been washed in by seasonal floods, with the flood waters sweeping over nearby stagnant pools, finally to loose their

force and spread out in the lagoonal/estuarine area. Fine sediment in suspension, as well as the mollusc and ostracode shells and the charophyte nucules would then settle on the bottom, along with the marine/estuarine shells already there. Deposition of these sediments occurred during a stillstand in a marine transgression (Tankard 1975*b*: 271).

The presence of the terrestrial *Trachycystis* can also be explained by flooding, or by strong wind action.

Comparison between the present fossil suite and the assemblage previously recorded from the Gravel Member of the same formation, shows that only two species occur in both. These are *Bullia digitalis* and *Donax serra*, both marine sand-dwelling species, still occurring on the nearby coast at Saldanha. The general dissimilarity is not surprising in view of the fact that the Gravel Member material was evidently accumulated in a marine beach environment. The differences between the two assemblages do not necessarily have any temporal significance.

ACKNOWLEDGEMENTS

I am grateful to Mr C. Appleton, Mr R. N. Kilburn, and Dr A. J. Tankard for reading the manuscript and for their useful criticisms; to Dr Q. B. Hendey for comments and for making the material available; to Prof. R. D. Wood of the University of Rhode Island, U.S.A., for his comments on the Charophytes; to Mr D. Gerneke for the photographs, and to Dr Tankard for arranging for the electromicrographs to be taken at Rhodes University, Grahamstown.

REFERENCES

- BARNARD, K. H. 1959. Contributions to the knowledge of South African marine Mollusca. Part II. Gastropoda: Prosobranchiata: Rhachiglossa. — *Ann. S. Afr. Mus.* **45**: 1–237.
- BARNARD, K. H. 1962. Revised list of South African Late Tertiary and Pleistocene marine Mollusca. — *Trans. R. Soc. S. Afr.* **36**: 179–196.
- BARNARD, K. H. 1963. Contributions to the knowledge of South African marine Mollusca. Part IV. Gastropoda: Prosobranchiata: Rhipidoglossa, Docoglossa. Tectibranchiata. Polyplacophora. Solenogastres. Scaphopoda. — *Ann. S. Afr. Mus.* **47**: 201–360.
- BROWN, D. S. & MANDAHL-BARTH, G. 1973. Two new genera of Planorbidae from Africa and Madagascar. — *Proc. malac. Soc. Lond.* **40**: 287–302.
- BURCH, J. B. 1975. Apical shell sculpture of some African freshwater limpets (Mollusca: Basommatophora: Ancyliidae). — *Zool. afr.* **10**: 53–62.
- CONNOLLY, M. 1939. A monographic survey of South African non-marine Mollusca. — *Ann. S. Afr. Mus.* **33**: 1–660.
- HENDEY, Q. B. 1976. The Pliocene fossil occurrences in 'E' Quarry, Langebaanweg, South Africa. — *Ann. S. Afr. Mus.* **69**: 215–247.
- KENSLEY, B. F. 1972. Pliocene marine invertebrates from Langebaanweg, Cape Province. — *Ann. S. Afr. Mus.* **60**: 173–190.
- MCKENZIE, K. G. 1971. Species list of South African freshwater Ostracoda with an appendix listing museum collections and some further determinations. — *Ann. S. Afr. Mus.* **57**: 157–213.
- NICKLÉS, M. 1955. Scaphopodes et lamellibranches récoltés dans l'Ouest africain. — *Atlantide Rep.* **3**: 93–238.

- STEPHENS, E. L. 1929. Fresh water aquatic vegetation of the south-western districts. *In*: ADAMSON, R. S., *et al.*, eds. *The Botanical features of the south-western Cape Province*. Cape Town: Speciality Press.
- TANKARD, A. J. 1975a. Thermally anomalous Late Pleistocene molluscs from the south western Cape Province, South Africa.—*Ann. S. Afr. Mus.* **69**: 17–45.
- TANKARD, A. J. 1975b. Varswater Formation of the Langebaanweg–Saldanha area, Cape Province.—*Trans. geol. Soc. S. Afr.* **77**: 265–283.
- VAN BRUGGEN, A. C. 1970. Non Marine Mollusca. *In*: HANSTRÖM, B., BRINCK, P., & RUDEBECK, G., eds. *South African animal life* **14**: 444–476. Lund: Berlingska Boktryckeriet.

6. SYSTEMATIC papers must conform with the *International code of zoological nomenclature* (particularly Articles 22 and 51).

Names of new taxa, combinations, synonyms, etc., when used for the first time, must be followed by the appropriate Latin (not English) abbreviation, e.g. gen. nov., sp. nov., comb. nov., syn. nov., etc.

An author's name when cited must follow the name of the taxon without intervening punctuation and not be abbreviated; if the year is added, a comma must separate author's name and year. The author's name (and date, if cited) must be placed in parentheses if a species or subspecies is transferred from its original genus. The name of a subsequent user of a scientific name must be separated from the scientific name by a colon.

Synonymy arrangement should be according to chronology of names, i.e. all published scientific names by which the species previously has been designated are listed in chronological order, with all references to that name following in chronological order, e.g.:

Family Nuculanidae

Nuculana (Lembulus) bicuspidata (Gould, 1845)

Figs 14–15A

Nucula (Leda) bicuspidata Gould, 1845: 37.

Leda plicifera A. Adams, 1856: 50.

Laeda bicuspidata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (figs 8a–b).

Nucula largillierii Philippi, 1861: 87.

Leda bicuspidata: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

Note punctuation in the above example:

comma separates author's name and year

semicolon separates more than one reference by the same author

full stop separates references by different authors

figures of plates are enclosed in parentheses to distinguish them from text-figures

dash, not comma, separates consecutive numbers

Synonymy arrangement according to chronology of bibliographic references, whereby the year is placed in front of each entry, and the synonym repeated in full for each entry, is not acceptable.

In describing new species, one specimen must be designated as the holotype; other specimens mentioned in the original description are to be designated paratypes; additional material not regarded as paratypes should be listed separately. The complete data (registration number, depository, description of specimen, locality, collector, date) of the holotype and paratypes must be recorded, e.g.:

Holotype

SAM–A13535 in the South African Museum, Cape Town. Adult female from mid-tide region, King's Beach, Port Elizabeth (33°51'S 25°39'E), collected by A. Smith, 15 January 1973.

Note standard form of writing South African Museum registration numbers and date.

7. SPECIAL HOUSE RULES

Capital initial letters

- The Figures, Maps and Tables of the paper when referred to in the text
e.g. '... the Figure depicting *C. namacolus* ...'; '... in *C. namacolus* (Fig. 10) ...'
- The prefixes of prefixed surnames in all languages, when used in the text, if not preceded by initials or full names
e.g. Du Toit but A. L. du Toit; Von Huene but F. von Huene
- Scientific names, but not their vernacular derivatives
e.g. Therocephalia, but therocephalian

Punctuation should be loose, omitting all not strictly necessary

Reference to the author should be expressed in the third person

Roman numerals should be converted to arabic, except when forming part of the title of a book or article, such as

'Revision of the Crustacea. Part VIII. The Amphipoda.'

Specific name must not stand alone, but be preceded by the generic name or its abbreviation to initial capital letter, provided the same generic name is used consecutively.

Name of new genus or species is not to be included in the title: it should be included in the abstract, counter to Recommendation 23 of the Code, to meet the requirements of Biological Abstracts.



BRIAN KENSLEY
A SECOND ASSEMBLAGE OF PLIOCENE
INVERTEBRATE FOSSILS FROM
LANGEBAANWEG, CAPE